Synopsis

This thesis proposes innovative methods to extract information embedded in the frequency and time domain response of the transformer winding, and utilizes them to suggest solutions to a few tasks that have until now been thought difficult, if not impossible, to resolve. Pursuing this philosophy originated from the basic understanding that the response of any physical system (behaving largely as a linear time invariant system) has embedded information that characterizes it completely. So, the prerequisite is to evolve ways to extract this information from measured responses. Once that is done, a variety of interesting applications can be envisaged. The two applications considered in this thesis are-

- Investigate indirect measurement of the series capacitance of a transformer winding using the measured frequency or time domain response
- Explore the possibility of increasing the physical resolution of the ladder network used to model a fully interleaved-disk winding

In the former application, since direct measurement of series capacitance is impossible, alternatives based on indirect measurement were also not attempted. Similarly, in the latter application, the upper limit is known to be fixed by the number of distinctly observable peaks in the magnitude frequency response, so the question of increasing this limit was also never explored. Solutions to these tasks are proposed after a systematic analysis of frequency/time domain responses of a winding, initially modeled as a lumped parameter ladder network, to extract correlations that exist between them and winding parameters, and finally examine how these relations can be exploited together with the measured responses. Each of the five chapters is dedicated to describe the solution to one task. In each chapter, analytical formulation is presented first, followed by experimental results. Good agreement with the predicted results demonstrates its practicability.

In final summary, indirect measurement of the series capacitance of a winding and enhancing physical resolution of a ladder network model to represent a fully interleaved-disk winding was successfully demonstrated and they are the main contributions of this thesis.